

Supplementary Information (ESI_3)

Microstructural transitions in resistive random access memory composed of molybdenum oxide with copper during switching cycles

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EDX analysis of the conductive filament

For characterization of the conductive filament (CF), we measured energy dispersive X-ray spectra (EDX) using a Jeol JEM 2010F microscope with an EDX detector. To maintain the CF during sample transfer from a microscope used for in-situ TEM (Jeol JEM 2010) to this microscope, high power was injected in the set process, and a thick CF was formed. The result is shown in Fig. S1. The investigated regions are marked with circles in Fig. S1(a). The regions 1 and 2 are in MoO_x without the CF, while the region 3 is at the CF. To prevent signals from the Cu top electrode (TE), the region 3 was established to be apart from the Cu TE as far as possible. As identified in Fig. S1(b), the spectrum from the region 3 contains much stronger Cu peaks than the other regions. Therefore, it was concluded that the CF in this work contained much Cu (probably metallic Cu).

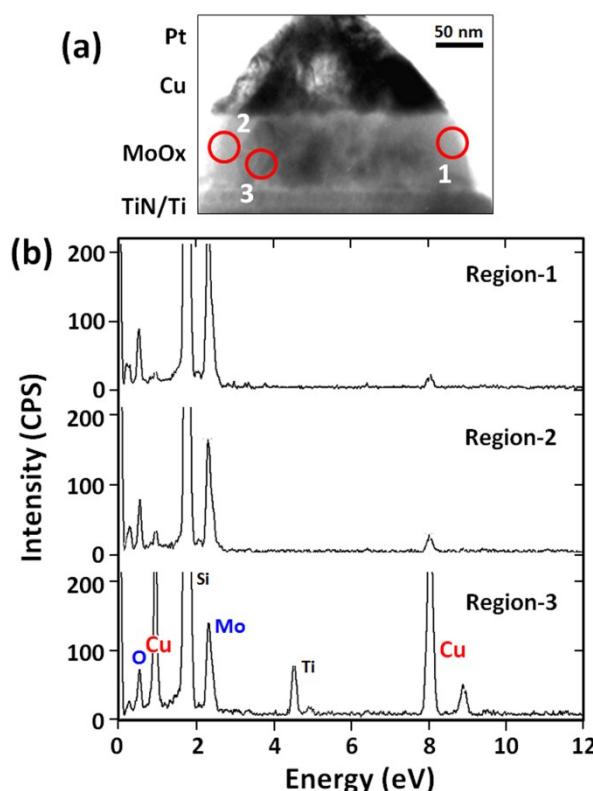


Fig. S1 (a) TEM photograph of the sample for EDX measurements. Only the region 3 contained the CF. (b) EDX spectra from three regions. The Si peak was from the massive Si substrate, while the Ti peak was from the neighbouring bottom electrode. The region 3 contained much more Cu than regions 1 and 2.